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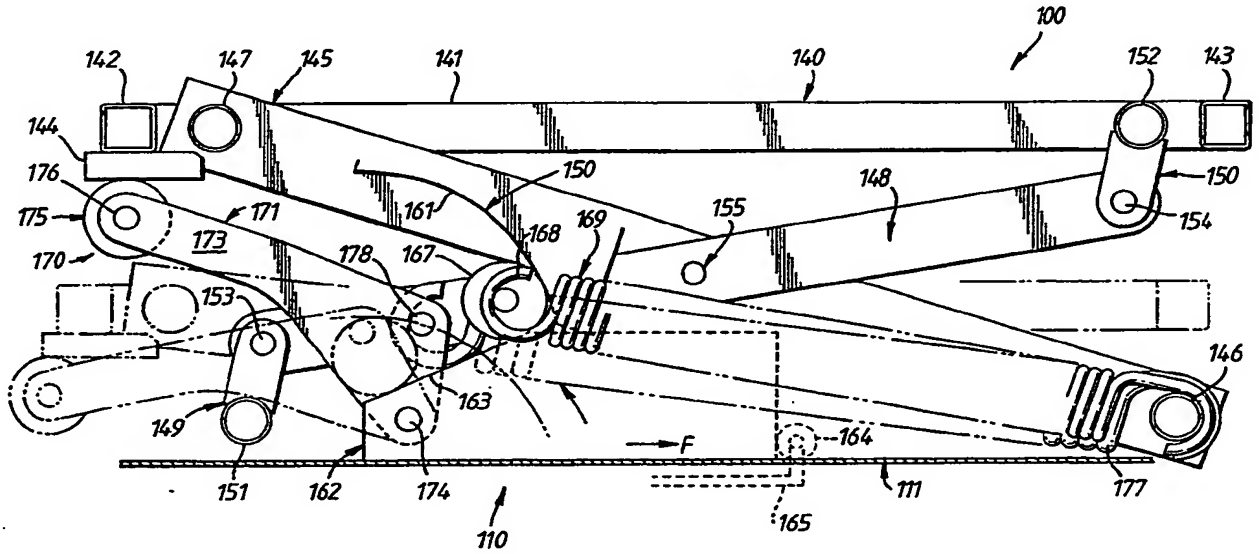

(57) Abstract

A vehicle seat suspension unit (100) has a base frame (110) mountable in a vehicle and a seat support frame (140) on which is mounted a vehicle seat. A scissor-arm assembly, with primary links (145) and secondary links (148) interconnect the frames (110, 140) overlapping cam tracks (160, 162), with cam profiles (161, 163) are engaged by rollers (167) attached to main springs (169) anchored on the base frame (110). As the frames (110, 140) move towards each other, the main springs (169) are extended as the rollers (167) move along the cam tracks (161, 163) to apply a restoring force to the frames (110, 140). A preload assembly (170) has rocker arms (171), pivotally mounted on the cam tracks (162), with rollers (175) bearing on the seat support frame (140) and provided with preload springs (177). By adjustment of the cam tracks (172) relative to the base frame (110) the preload and the main spring (169) rate can be varied to suit the operator's weight.

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TITLE: "VEHICLE SEAT SUSPENSION UNIT"

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

THIS INVENTION relates to a vehicle seat suspension unit. The term "vehicle" shall be used to include automobiles, four-wheel-drives (4WD), trucks, prime movers, earthmoving machines (eg. bulldozers), aircraft and watercraft.

2. PRIOR ART

A vehicle operator's comfort and efficiency is dependent on providing a suitable suspension unit for his seat to eliminate, or at least reduce, the shocks and vibration transmitted from the vehicle to the operator via his seat.

Many suspension units have been proposed to reduce the shocks and vibration. Generally, most rely on a spring-loaded seat support frame which is damped by a hydraulic or pneumatic damper unit. An example is disclosed in AU-B-66509/86 (582031) (D.M. Culley et al). The major problem with these units is that the damping can effectively be so slow that the suspension unit goes out of phase with the vehicle suspension and the damping can apply an additive shock to the operator's seat. In many cases, operators remove the damping effect as it is preferable to have a "floating" undamped suspension unit than a poorly damped one.

One of the reasons for the failure of the existing suspension units has been a basic misunderstanding of seat suspension unit design. The design objective is to provide a unit where the operator's seat follows an almost undisturbed path as the vehicle passes over bumps or depressions. In the past, the designers have worked on the principle of the seat moving relative to the vehicle, whereas they could have been designing for movement of the vehicle

relative to the seat. In addition, they have applied damping to the suspension unit which is not required.

SUMMARY OF THE PRESENT INVENTION

It is an object of the present invention to provide a seat suspension unit which provides improved insulation from shock and vibration compared to existing units.

It is a preferred object to provide a unit where damping per se is not required.

It is a further preferred object to provide a unit which has a rising suspension rate from its normal preload position.

It is a still further preferred object to provide an adjustable preload to the unit to suit the weight of the operator.

It is a still further preferred object to provide a unit which has a very low profile and which incorporates the seat runners within its base frame.

Other preferred objects of the present invention will become apparent from the following description.

In one aspect the present invention resides in a vehicle seat suspension unit including:

a base frame mountable on a vehicle;

a seat support frame to mount a vehicle operator's seat;

a scissor arms assembly interconnecting the frames to enable the frames to move relative to each other substantially in parallelism;

a pair of cam track means on the scissor arms assembly engageable by respective cam follower means mounted on a follower support means; and

spring means interconnecting the follower support means and the scissor arms assembly or one of the frames;

so arranged that as the frames move relatively towards each other, the cam follower means travel along the cam track means to extend the spring means, the extension of the spring means opposing the movement of the frames from their relative initial position.

In a second aspect, the present invention resides in a vehicle seat suspension unit including:

a base frame mountable on a vehicle;

a seat support frame to mount a vehicle operator's seat;

a scissor arms assembly interconnecting the frames to enable the frames to move relative to each other substantially in parallelism;

a pair of cam track means having a first cam track on the scissor arms assembly and a second cam track on one of the frames, the cam track means being engageable by respective cam follower means mounted on a follower support means; and

spring means interconnecting the follower support means and the scissor arms assembly or one of the frames;

so arranged that as the frames move relatively towards each other, the cam follower means travel along the cam track means to extend the spring means, the extension of the spring means opposing the movement of the frames from their relative initial position.

Preferably, the frames are substantially rectangular in plan view. Preferably, the base frame incorporates the runners or slides for longitudinal adjustment of the seat in the vehicle.

The seat support frame may have the seat bolted to it or the frame may be moulded into the base of the seat.

Preferably, the scissor arms assembly includes a pair of primary scissor arms and a pair of secondary

scissor arms pivotally connected to the frames and to each other. The second scissor arm may be connected to the frames by pivotal links. Reinforcing plates may connect the arms in each pair.

Preferably, the cam tracks overlap, the cam tracks moving towards each other as the frames move together. Preferably, the cam tracks are offset so that each is engaged by a respective roller (as the cam follower means). Preferably the shape of the cam tracks prevents the "bottoming out" of the frame.

Preferably, the rollers are rotatably mounted on the ends of a transverse yoke (as the follower support means) and a pair of tension springs connect the yoke to the base frame.

An adjustable preload unit may be provided, with a rocker arm pivotally mounted at one end of one of the cam tracks and with a roller engageable with one of the frames, a preload spring being connected to the rocker arm, intermediate its length, and to the other of the frames.

One of the cam tracks of each pair may be adjustable to vary the preload on the preload unit and the tension on the spring means.

Preferably, the seat adjustment sides are vertical and are separated by an anti-function element which also acts as a spring element to provide rattle free assembly and use over a wide range of component tolerances.

Preferably, the seat adjustment slides incorporate a latching mechanism, preferably located within the rack forming the slides, able to provide restraint against loads applied by the fitting of a seat belt to the seat or seat support frame.

A bellows (or diaphragm) means may be provided between the two frames to control the movement between the frames. Preferably, the bellows only provides

effective control at the end of its opening stroke to prevent "topping-out" of the frames.

BRIEF DESCRIPTION OF THE DRAWINGS

To enable the invention to be fully understood, a number of preferred embodiments will now be described with reference to the accompanying drawings, in which:

FIG 1 is a side view of a first embodiment of the unit, parts being shown in section for clarity;

FIG 2 is a top plan view of the unit;

FIG 3 is a sectioned side view taken on line 3-3 on FIG 2;

FIG 4 is a sectioned end view of the bellows taken on line 4-4 on FIG 3;

FIG 5 is a side view of a second embodiment of the unit, parts being omitted for clarity;

FIG 6 is a plan view of one half of the second embodiment, parts being omitted for clarity;

FIG 7 is a section side view of one of the seat slide assemblies;

FIG 8 is a sectional end view taken on line A-A on FIG 7; and

FIG 9 is a sectional end view taken on line B-B on FIG 7.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS 1 to 3, the first embodiment of the seat suspension unit 10 has a substantially U-shaped base frame 11, the side rails 12 which are of RHS steel, and the rear rail 13 of which is of angle-sectioned steel. The ends of the bottom walls of the side rails 12 are slotted to receive the studs 14 of the seat runners 15 slidably received in the side rails 12. Each runner 15 is releasably locked by a transverse pin 16 which has a finger 17 received in a cam slot 18 in a boss 19. An operating handle 20 extends across the front of the base frame 11 and is connected to the

fingers 17 by rods 21. By rotation of the handle, the pins 16 are rotated and moved to a retracted position by the fingers 17 moving in their cam slots 18. The pins are urged into their locked positions by springs 22 via rods 23.

A substantially rectangular seat support frame 24 has side rails 25 and a rear rail 26 of RHS steel and a front rail 27 of flat steel.

The base frame 11 and seat support frame 24 are connected one above the other in parallel by a pair of primary scissor arms 28 and a pair of secondary scissor arms 29, the middle part of each secondary scissor arm 29 being pivoted to the middle part of a primary scissor arm 28 by a pivot pin 30. Transverse plates 31, 32 reinforce (and interconnect) the respective scissor arm pairs 28, 29.

The top or front ends of the two primary scissor arms 28 are pivoted about a transverse axis (defined by a transverse shaft) within the front end of the seat support frame 24. The bottom or front ends of the secondary scissor arms 29 are pivoted about a transverse axis (defined by a transverse shaft 33) within the front end of this seat support frame 11. The bottom or rear ends of the two primary scissor arms 28 have pivot pins 34 slidably received in slots 35 in blocks 36 at the inner sides of the rear ends of the side rails 12 of the base frame 11, and the upper and rear ends of the two secondary scissor arms 29 have similar pivot pins 37 slidably received in slots 38 in blocks 39 on the inner side of the rear ends of the side rails 26 of the seat support frame 24.

Respective cam tracks 40, 41 are provided on the rear ends of the primary and secondary scissor arms 28, 29. The forward ends of the cam tracks overlap and the cam tracks are transversely offset in front view.

A pair of rollers 42 (spaced by a washer) are rotatably mounted on axles 43 at each end of a substantially U-shaped transverse yoke 44.

A pair of tension springs 45 are anchored at one end to the yoke 44 and at the other end to a balance bar 46 which has a central screw-threaded rod 47 which receives a nut 48. The nut 48 bears on a bracket 49 on the reinforcing plate 32 interconnecting the forward ends of the secondary scissor arms 29.

A bellows assembly 50 has a flexible rubber bladder 51 supported by an internal coil spring 52, the base of the bladder 51 being secured to a rear rail 13 of the base frame 11. A bracket 54 connects the top of the bladder 51 to the rear rail 26 of the seat support frame 24, the bracket being secured by a nut 55 on a threaded tube 56 open to the interior of the bladder.

A rubber valve member 57 is normally urged into engagement with the end of the tube 56 by a lightweight compression spring 58 and is unseated to allow the rapid egress of air when the bellow assembly 50 is collapsed by the frames 11, 24 moving towards each other. A relatively large diameter hole 59 in the valve member 57 allows relatively unrestricted egress of the air into the bellows assembly 50 when the frames 11, 24 are moved apart.

The operation of the suspension unit 10 will now be described. NB. It will be assumed that the seat support frame remains relatively stationary and that the base frame moves vertically relative to it, i.e., the path of the operator's seat is relatively undisturbed as the vehicle moves over bumps and holes (or waves and troughs for watercraft).

The seat runners 15 are bolted to the floor of the vehicle cabin (not shown) via the studs 14 and the position of the suspension unit 10 (and the seat) can be

adjusted by operating handle 20 to release the pins 16 to allow the seat frame 11 to move along the runners 15.

The operator sits in the seat (not shown) bolted to the seat support frame 24 and the distance between the frames is reduced to the initial preload height determined by the tension set on the springs 45 via adjustment of the nut 48. (This allows operators of different weights to be easily accommodated). When the vehicle strikes a bump and tends to rise, the base frame 11 moves upwardly (in the direction of arrow A) towards the seat support frame (as a datum). The cam tracks 40, 41 converge due to the closing of the scissor arms 28, 29 about their pivot pins 30 and the rollers are urged rearwardly in the direction of the arrow B. The yoke 44 pulls on the springs 45 and the base frame 11 rises until the tension in the springs 45 on the yoke 44 equals the force on the rollers 42 from the cam tracks 40, 41 tending to move the rollers in the direction of arrow B.

When the vehicle passes over the bump, the rollers 42 are pulled against the cam tracks 40, 41 in the direction opposite to arrow B to restore the distance between the frames 11, 24.

As the displacement of the base frame 11 in the direction of arrow A increases the angular displacement of the scissor arms 28, 29 at an increasing rate, the suspension unit has a rising rate of force opposing further vertical displacement of the base frame 11 from its initial position. This means that the effective springing rate of the unit increases with displacement of the base frame from its initial preload position. The shape of the cam tracks prevents the seat frame from bottoming out.

When the vehicle falls into a hole, the base frame 11 will move in the direction opposite to arrow A and the rollers will move in the direction opposite to

arrow B. By selecting the contours of the cam tracks 40, 41, a reduced restoring force is applied on the rollers 42 by the springs and the base frame 11 can then move in the direction of arrow A toward its initial preload position.

The bellows assembly 50 does not provide damping but only travel control when the vehicle encounters a hole. Assuming the vehicle has encountered a bump and the base frame 11 is moved in the direction of arrow A, the bladder 51 begins to collapse, supported by the internal spring 52 and air is exhausted from the bladder by the unseating of the valve member 57. The pressure inside the bladder exceeds atmospheric pressure towards the end of the stroke. When the base frame begins to fall (ie. move in the direction opposite to arrow A), the valve member 57 is reseated but the air rapidly enters the bladder via the hole 59. Initially, the air pressure in the bladder falls to atmospheric and it is only towards the end of the stroke that the pressure becomes negative (ie. a vacuum) to provide a "damping" effect and indeed, is more accurately termed a travel control. This prevents the frames going past the pre-load position and "topping-out".

By changing the profile of the cam tracks 40, 41 and the tension on the springs 45, the seat suspension unit 10 can be tailor made for a particular operator, eg. an owner/driver of an interstate semi-trailer. However, general cam track profiles can be provided which, with adjustment of the tension of the springs, can enable a wide range of operators to use the unit and receive a very high standard of ride. Because the bellows does not provide damping, but only travel control, the unit does not allow the operators' seat to go out-of-phase with the vehicle suspension and so a high quality ride is ensured.

Referring now to FIGS 5 and 6, the second embodiment of the seat suspension unit 100 has a base frame 110 formed from sheet metal and incorporating a floor plate 111 with side flanges 112 (see FIGS 8 and 9).

Referring to FIGS 7 to 9, a top-hat section frame slide rail 113 is fixed to each side flange 112 and is slidably received in a base slide rail 114 anchored to the vehicle floor by studs (not shown) where their heads are received in the T-shaped slot 15 in the bottom of the base slide rail 114. The side flanges of the frame slide rail 113 are received in the channel-section anti-friction strips 116, 117, with integral side lips which act as spring elements to provide a rattle-free seat slide assembly.

A horizontal flange 118 on the base slide rail 114 is provided with a series of equally spaced slots or holes 119 which are releasably engageable by teeth 120 on a pivotally mounted locking bar 121, the locking bar 121 being hingedly mounted within the frame slide rail 113 as a pivot pin 122.

The operation of the locking bar 121 is controlled by a release bar 123 slidably mounted within the frame slide rail 113, with a pin 124 on the frame silde rail 113 being received with an elongate slot 125 in the release bar 123.

A bell-crank 126 is pivotally mounted, via first shaft 127, on a vertical plate 128 at the forward end of the frame slide rail 113, and has a handle (not shown). A pin 129 on the leg 130 of the bell-crank 126 is received in a slot 131 at the end of the release bar 123. The other end of the release bar 123 is provided with an inclined, elongated loop member 132 with an inclined cam slot 133 in which is received a follower pin 134.

A tension spring 135 is anchored at one end of the pin 124 on the frame slide rail 113 and at the other end on a pin 136 on the release bar 123.

The pivot shaft 127 interconnects the handle (not shown) to the bell-crank on the other seat slide assembly so that the two seat slide assemblies will operate in unison.

As the handle is raised, the bell-crank 126 pivots in the direction of arrow C and the pin 129 in slot 131 moves the release bar 123 forwardly in the direction of arrow D against the tension spring 135. As the loop member 132 advances, the follower pin 134 in the cam slot 133 moves the locking bar 121 downwardly in the direction of arrow E, to the position shown in dashed lines, where the teeth 120 are disengaged from the slots 119 in the flanges 118 on the base slide rail 114. The unit 100 can then be moved relative to the base slide rail 114 to allow adjustment of the seat position. On release of the handle, the release bar 123 returns to its original position and the teeth 120 on the locking bar 121 re-engage the slots 119 in the flange 118 to securely anchor the seat longitudinally.

Referring now to FIGS 5 and 6, the substantially rectangular seat support frame 140 has side rails 141, rear rail 142 and front rail 143 all of RHS steel. A horizontal plate 144 is welded to the underside of the rear rail 142.

The base frame 110 and the seat frame 140 are connected one above the other substantially in parallel by a pair of primary links 145, pivotally connected to the base frame 110 and the seat frame 140 via transverse tubes 146, 147, and by a pair of secondary links 148 which are connected to the base frame 110 and seat frame 140 by intermediate links (or pivot members) 149, 150. The intermediate links 149, 150 are pivotally mounted on the base frame and seat frame via pivot pins

151, 152 and are connected to the secondary links 148 via pivot pins 153, 154. The primary and secondary links are pivotally interconnected in a scissor-like arrangement, via a pivot pin 155. The primary links 145 are torsionally stiff and carry higher loads in bending and in torsion than the secondary links 148 which are stiffest in bending. By suitable choice of parameters, the motion of the seat with respect to the seat slide assemblies is essentially parallel with a small element of translation.

A respective first cam track 160, with a curved profile 161 is provided parallel to, but spaced from, each primary link, the cam tracks interconnecting the transverse tubes 146, 147. A respective second cam track 162, with an inclined ramp profile 163, is slidable mounted on the floor plate 111 of the base frame 110 and is selectively adjustable via a cam 164 controlled by a lever 165. The adjacent pairs of first and second cam tracks 160, 162 are arranged so that their profiles 161, 163 overlap.

A respective pair of rollers 166, 167 engage the respective cam tracks 160, 162, the rollers being provided at respective ends of a transverse bar 168, to which is anchored one end of a pair of main springs 169 anchored at the other end to the transverse tube 146.

An adjustable preload assembly 170 has a pair of rocker arms 171, formed of parallel side plates 172, 173, each pivotally anchored via a pivot pin 174 on a respective one of the secondary cam tracks 162. A roller 175 is rotatably mounted on an axle 176 at the other end of each rocker arm 171, and bears on the underside of the horizontal plate 144. A preload spring 177 is provided for each rocker arm 171, being connected to a transverse pin 178, interconnecting the side plates 172, 173, and anchored to the transverse tube 146.

The preload assembly 170, via the rocker arms 171 and the preload springs 177, together with the primary and secondary cam tracks 160, 162, and main springs 169, provide an essentially contstant preload in the vertical direction which is adjustable for different preloads by the operator.

In FIG 5, the secondary cam track 162 is shown in the position for maximum preload. If the cam 164 is rotated to allow the secondary cam track to move in the direction of arrow F, the rocker arms 171 mounted thereon will also move in direction of F and the tension on both the main springs 169 and the preload springs 177 will be reduced, reducing the preload on the unit.

Once the operator has set the preload, it will remain constant over a wide range of vertical positions in use and the spring stiffness is essentially zero. This provides isolation from the vehicle approaching 100% over the travel range (eg. of 70mm) between the initial preload position shown in solid lines in FIG 5 and the full travel position shown in dashed lines.

However, as the effective mass is constantly changing (due to change of posture, forces or controls and most importantly, the acceleration experienced by the seat slides, assemblies, which are attached to the vehicle), the main springs 169 and the cam tracks 160, 162 are incorporated to provide support of the effective mass less the preload, ie. Net Suspended Mass = Effective Mass - Preload.

This allows a fundamentally softer springing element, which for the low frequencies of vibration (the most sensitive to the operator) allows a significant reduction in force/acceleration/displacement transmission to be achieved by mechnical means.

As stated above, the adjustment of the secondary cam tracks 162 allows adjustment of both the

preload and the main spring rate to suit the operator's weight.

It will be readily apparent to the skilled addressee that the present invention provides a simple, yet highly efficient seat suspension unit and its comfort nature allows it to have a very low profile with the desired range of travel.

Various changes and modifications may be made to the embodiments described and illustrated without departing from the scope of the present invention as defined in the appended claims.

CLAIMS

1. A vehicle seat suspension unit including:

a base frame mountable on a vehicle;

a seat support frame to mount a vehicle operator's seat;

a scissor arms assembly interconnecting the frames to enable the frames to move relative to each other in parallelism;

a pair of cam track means on the scissor arms assembly engageable by respective cam follower means mounted on a follower support means; and

spring means interconnecting the follower support means and the scissor arms assembly or one of the frames;

so arranged that as the frames move relatively towards each other, the cam follower means travel along the cam track means to extend the spring means, the extension of the spring means opposing the movement of the frames from their relative initial position.

2. A unit according to Claim 1 wherein:

the scissor arms assembly includes a pair of primary scissor arms and a pair of secondary scissor arms pivotally connected to the frames and to each other;

reinforcing plates being provided to interconnect the scissor arms in each pair.

3. A unit according to Claim 2 wherein:

the cam tracks are provided on the scissor arms rearwardly of the pivotal interconnection of the arms, the cam tracks overlapping at their forward ends and being axially offset to be engaged by respective cam followers.

4. A unit according to any one of Claims 1 to 3 wherein:

the cam follower means are rollers rotatably mounted in spaced pairs at the ends of a transverse yoke provided as the cam follower support means.

5. A unit according to Claim 4 wherein:

the spring means includes a pair of springs interconnecting the yoke to a reinforcing plate interconnecting one of the pairs of scissor arms; and

means are provided to enable adjustment of tension on the springs.

6. A unit as claimed in any one of Claims 1 to 5 wherein:

the cam track means are profiled to provide a rising rate of spring stiffness as the distance between the frames is reduced due to displacement of the base frame relative to the seat support frame from an initial pre-load position.

7. A unit as claimed in any one of Claims 1 to 6 and further including:

a travel control unit including a bellows assembly interconnecting the two frames, the bellows providing a travel control as the base frame returns to an initial pre-load position after being displaced therefrom.

8. A unit as claimed in Claim 7 wherein:

the bellows assembly includes a bladder provided with an internal supporting spring;

a relatively large air passage to the interior of the bellows;

a valve means in the air passage arranged to be opened to allow the rapid egress of air from the bladder when the bladder is collapsed; and

an air bleed hole in the valve means to allow air to rapidly egress into the bladder when the bladder is restored, a vacuum being generated in the bladder at the end of its return stroke.

9. A vehicle seat suspension unit including:

a base frame mountable on a vehicle;

a seat support frame to mount a vehicle operator's seat;

a scissor arms assembly interconnecting the frames to enable the frames to move relative to each other substantially in parallelism;

a pair of cam track means having a first cam track on the scissor arms assembly and a second cam track on one of the frames, the cam track means being engageable by respective cam follower means mounted on a follower support means; and

spring means interconnecting the follower support means and the scissor arms assembly or one of the frames;

so arranged that as the frames move relatively towards each other, the cam follower means travel along the cam track means to extend the spring means, the extension of the spring means opposing the movement of the frames from their relative initial position.

10. A unit according to Claim 9 wherein:

the scissor arms assembly includes a pair of primary links pivotally connected to the frames, and a pair of second links connected to the frames by intermediate links pivotally connected to the frames, the primary and secondary links being pivotally connected intermediate their lengths.

11. A unit according to Claim 10 wherein:

the first cam tracks are mounted parallel to, and are movable with, the primary links;

the second cam tracks are adjustably mounted on the base frame; and

each respective pair of first and second cam tracks overlapping at their forward ends and being

axially offset to be engaged by respective cam follower means.

12. A unit according to any one of Claims 9 to 11 wherein:

the cam follower means are rollers rotatably mounted in spaced pairs at the ends of a transverse bar provided as the cam follower support means.

13. A unit according to Claim 12 wherein:

the spring means includes a pair of main tension springs interconnecting the transverse bar to the base frame; and

means are provided to enable tension of the main springs to be varied.

14. A unit according to Claim 13, when dependent on Claim 11, wherein the tension on the main springs is adjusted by movement of the second cam tracks relative to the base frame.

15. A unit according to any one of Claims 9 to 14 wherein:

the cam track means are profiled to provide a rising rate of spring stiffness as the distance between the two frames is reduced due to displacement of the base frame relative to the seat support frame an intiial preload position.

16. A unit according to any one of Claims 9 to 15 and further including:

a preload assembly to provide a substantiallly constant preload in a vertical direction to the unit over the full range of travel, where the assembly has a spring stiffness of approximately zero.

17. A unit according to Claim 16 wherein:

the preload assembly includes a pair of rocker arms mounted at one end of the cam track means;

roller means at the other end of the rocker arms engageable with one of the frames; and

preload springs interconnecting the rocker arms, intermediate their length, to the other of the frames.

18. A unit according to Claim 17 wherein:

the rocker arms are mounted on the second cam tracks, the roller means bear on the underside of the seat support frame and the preload springs are anchored to the base frame, adjustment of the second cam tracks on the base frame adjusting the preload on the unit.

19. A unit according to any one of Claims 1 to 18 wherein:

the base frame is provided with a pair of substantially vertical frame slide rails slidably received in base slide rails anchored to the vehicle floor; and

lock means releasably lock the respective slide rails to enable adjustment of the seat relative to the vehicle.

20. A unit according to Claim 19 wherein:

the frame slide rails are received in anti-friction elements in the base slide rails, the elements having integral spring lips or flanges to prevent the rails from rattling; and

the locking means includes locking bars, received within the frame slide means and pivotally mounted thereon, with teeth releasably engageable with slots or holes or flanges on the base slide rails.

21. A unit according to Claim 20 wherein:

a respective release bar is slidably mounted on each frame slide rail, movable by a lever via a bell-crank mechanism, the release bar having an inclined cam slot engageable by a pin on its associated locking bar and so arranged that as the release bar is advanced from an initial position, the cam slot causes the pin to move

the teeth out of locking engagement with the slots or holes in the flange on the base slide rail;

spring means being provided to urge the release bar to its initial position.

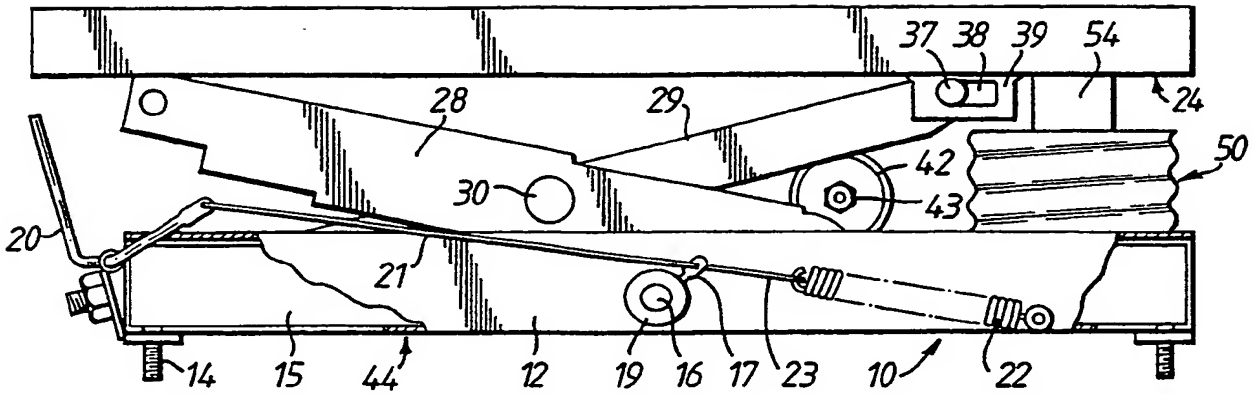

Fig. 1.

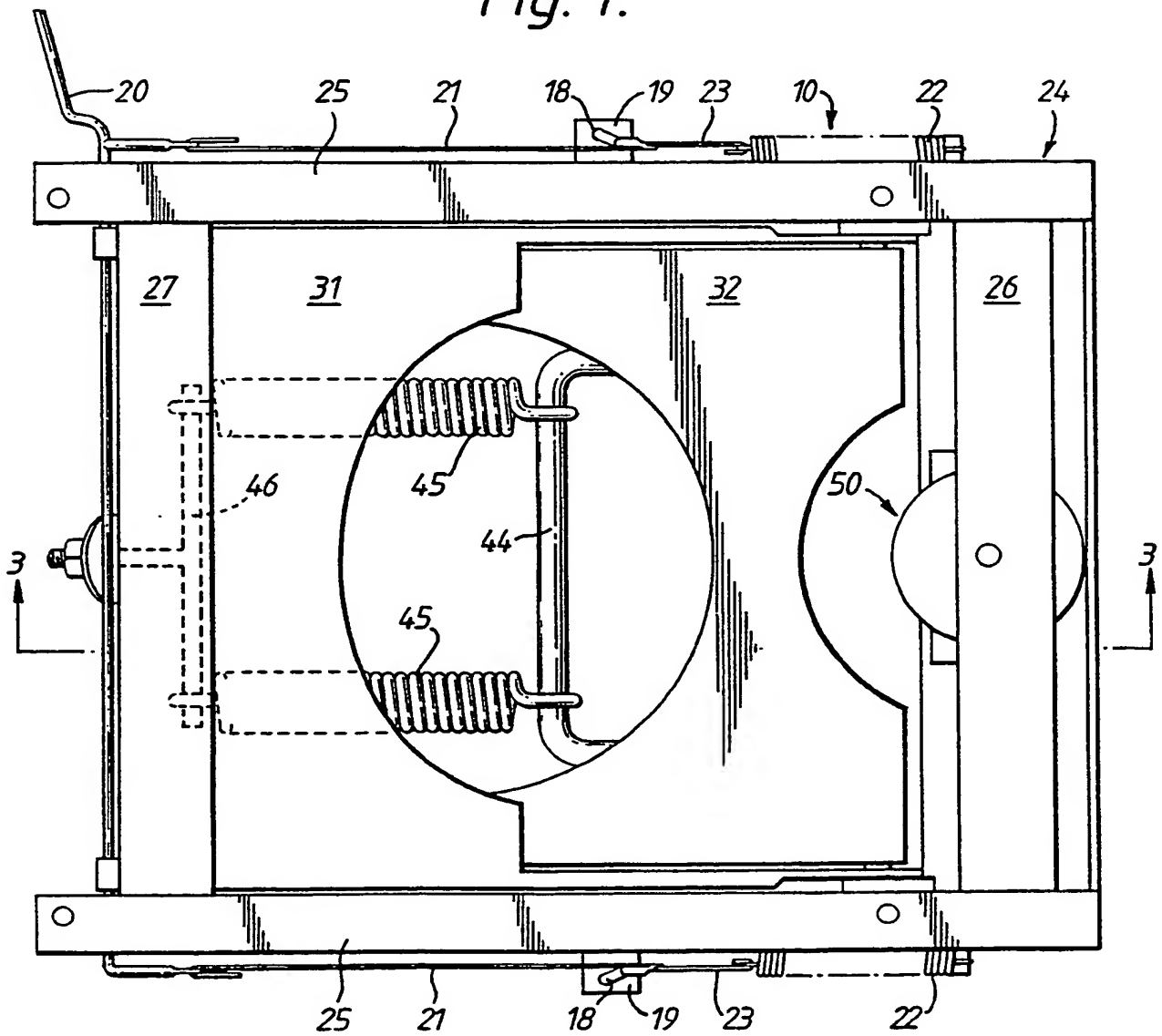

Fig. 2.

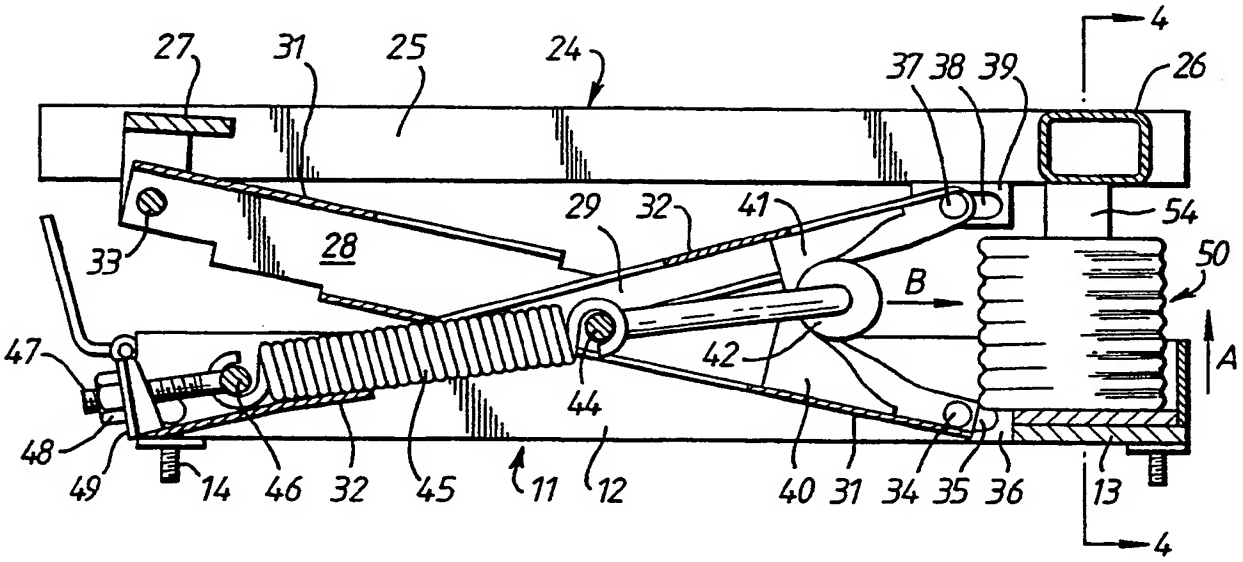

Fig. 3.

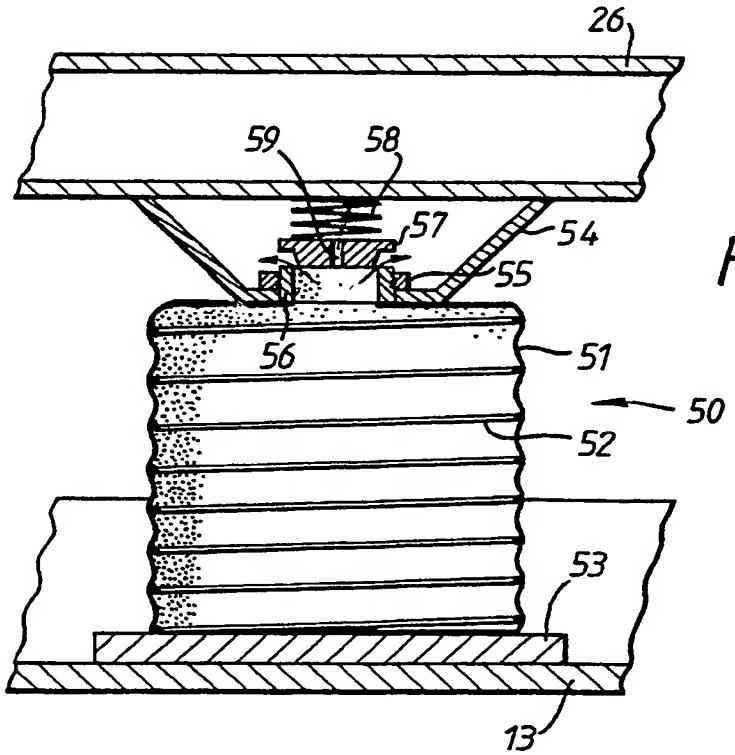

Fig. 4.

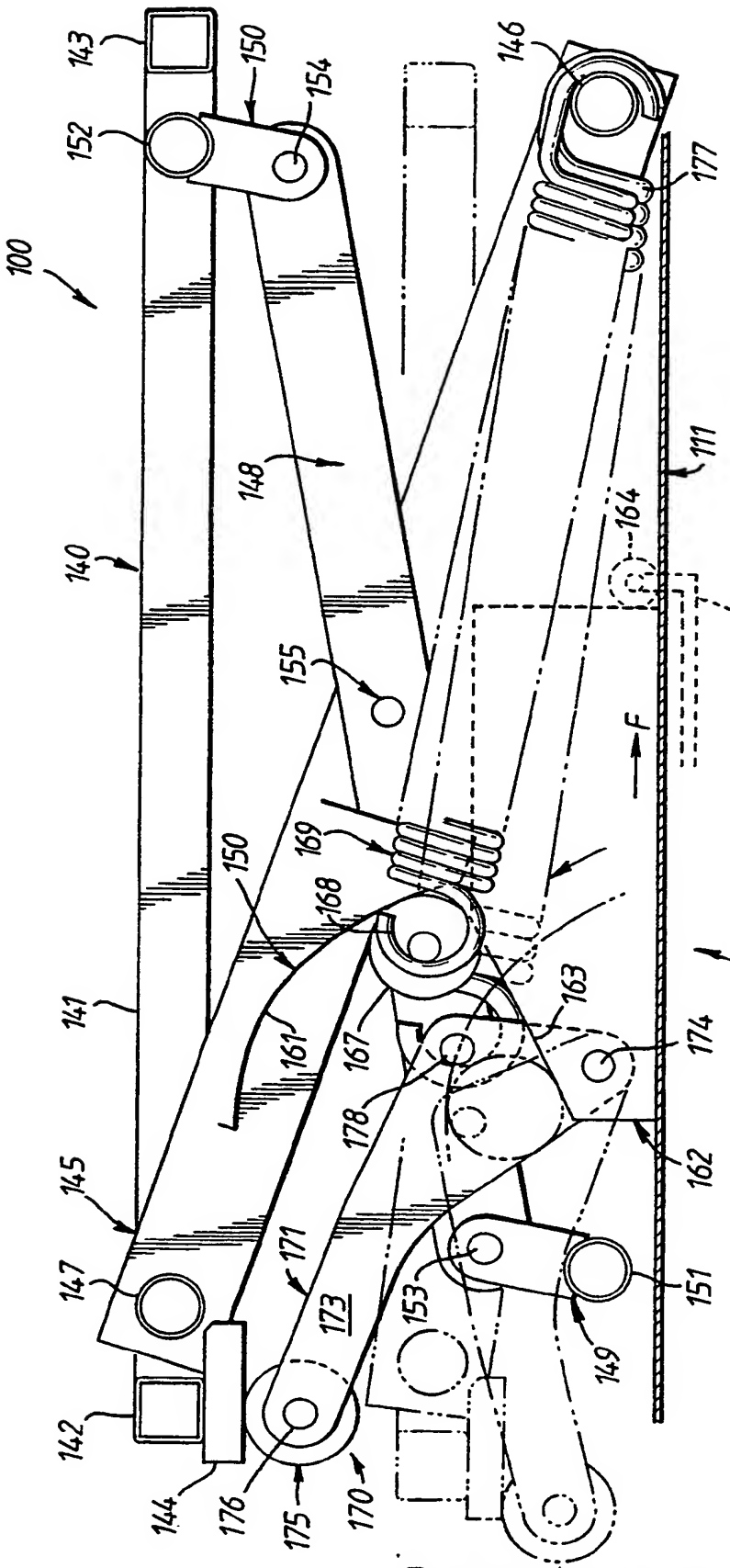

Fig. 5.

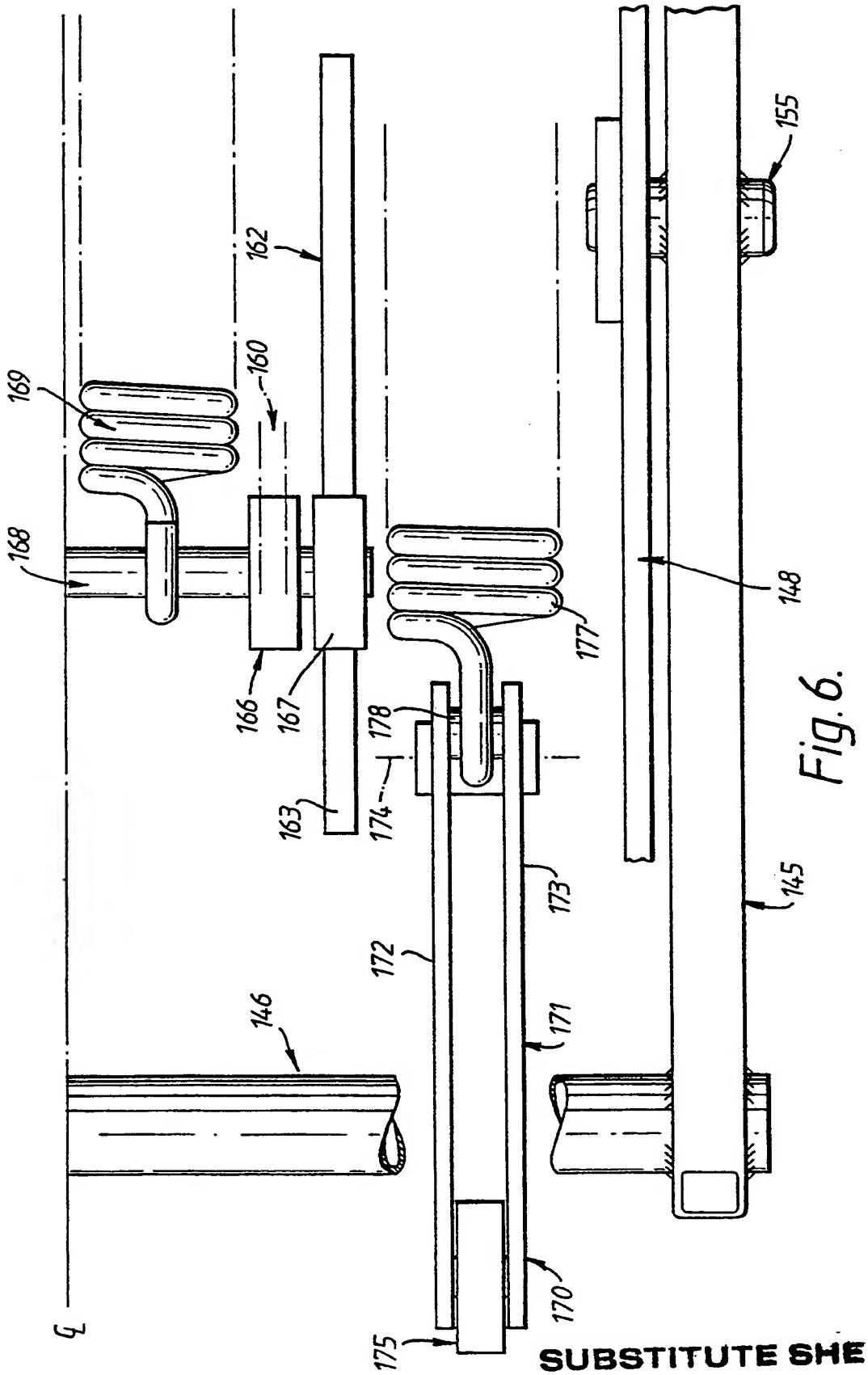

Fig. 6.

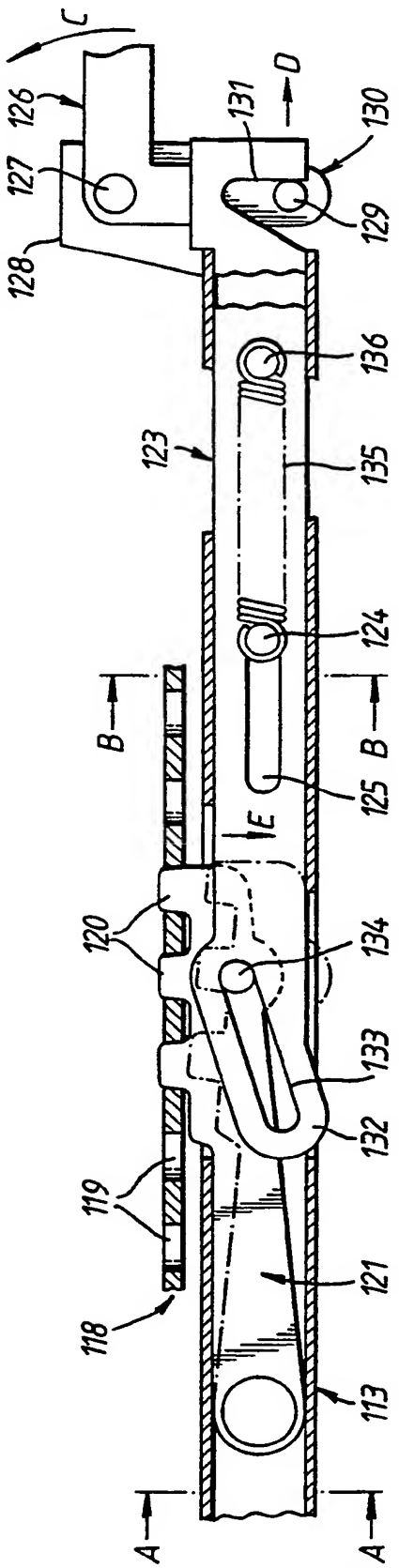

Fig. 7.

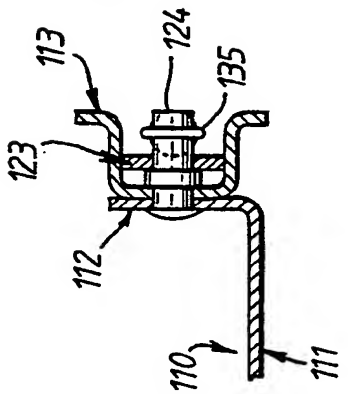

Fig. 9.

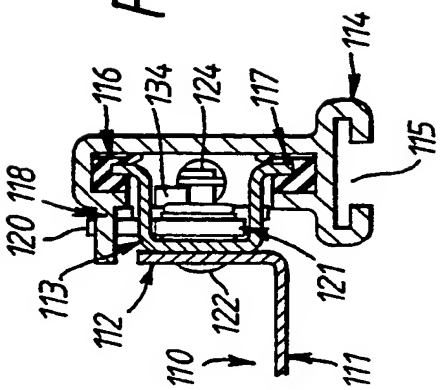

Fig. 8.

INTERNATIONAL SEARCH REPOPT

International Application No. PCT/AU 90/00144

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[5] B06N 2/54

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
IPC	B60N 2/54, 1/02

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category*	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
X	US,A, 4125242 (METLLER et al) 14 November 1978 (14.11.78). See column 5 line 47 to column 6 line 42, Figs 1, 2 & 3 and the abstract.	(1-15)
A	EP,A, 80892 (UOP Inc.) 8 June 1983 (08.06.83). See the abstract, page 6 line 9 - page 9 line 8 and Figs 1 & 2.	
A	EP,A, 149007 (UOP Inc.) 24 July 1985 (24.07.85). See the abstract and Figs 1 & 2.	
A	DT,A, 2359326 (Fritzmeier) 12 June 1973 (12.06.73). See Figs 1 & 2.	

(continued)

* Special categories of cited documents: 10

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
2 August 1990 (02.08.90)	7 August 1990
International Searching Authority	Signature of Authorized Officer
Australian Patent Office	P.J. WHITE

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category*	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	GB,A, 1521316 (SOCIETE INDUSTRIELLE BERTRAND FAURE SA) 16 August 1978 (16.08.78). See page 1 lines 47 to 67 and Figs 1 & 2.	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 90/00144

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members		
US 4125242	BR 7506270	DE 2446516	FR 2286023
	GB 1491292	JP 51053954	SE 7510565
EP 80892	EP 149007	ES 517794	ES 8402534
	US 4448386		
EP 149007	EP 80892	ES 517794	ES 8402534
	US 4448386		
DE 2359326			
GB 1521316	BE 833368	DE 2539332	FR 2284479
	IT 1050842		

END OF ANNEX